Experiments and Notes ABOUT THE MECHANICAL PRODUCTION OF Magnetiſm.

By the Honourable
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Fellow of the *R. Society.*

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A CONTINUATION
OF
MECHANICAL
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ADVERTISEMENT

Concerning the following

NOTES

About OCCULT

QUALITIES.

THE following Papers (about Magnetiſm *and* Electricity*) would appear with leſs diſadvantage, if the Author's willingneſs and Promiſe, that this Tome ſhould be furniſhed with notes about ſome* Occult Qualities, *as well as about divers ſorts of thoſe that are preſumed to be* Manifeſt, *did not prevail with him to let the enſuing Notes appear without thoſe about the* Pores *of Bodies and* Figures *of Corpuſcles, that ſhould have preceded them, and ſome others that ſhould have*

accompanied them. But the Author choſe rather to venture theſe Papers abroad in the Condition, ſuch as 'tis, they now appear in, than make thoſe already printed about manifeſt *Qualities ſtay longer for Acceſſions, which ſome troubleſome Accidents will not ſuffer him to haſten to the preſs; and without which, he now fears this Tome may ſwell to a more than competent Bulk.*

EXPE-

Experiments and Notes ABOUT THE MECHNICAL PRODUCTION OF MAGNETICAL QUALITIES.

THough the vertues of the *Loadſtone* be none of the leaſt famous of *Occult* Qualities, and are perhaps the moſt juſtly admired; yet I ſhall venture to offer ſomething to make it probable; that ſome, even of theſe, may be introduced into bodies by the production of *Mechanical* changes in them.

To make way for what I am to deliver to this purpoſe, it will be ex-

pedient to remove that general and ſettled prejudice, that has kept men from ſo much as thinking of any Mechanical account of Magnetiſms, which is a belief, that theſe Qualities do immediately flow from the *Subſtantial Form* of the Loadſtone, whoſe abſtruſe nature is diſproportionate to our underſtandings. But for my part, I confeſs, I ſee no neceſſity of admitting this ſuppoſition; for I ſee, that a piece of Steel fitly ſhaped and well excited, will, like a Loadſtone, have its determinate Poles, and with them point at the North and South; it will draw other pieces of Iron and Steel to it, and which is more, communicate to them the ſame kind, though not degree, of attractive and directive vertue it had it ſelf, and will poſſeſs theſe faculties not as light and tranſient impreſſions, but as ſuch ſetled and durable Powers that it may retain them for many years, if the Loadſtone, to which it has been duly

EXPER. I.

duly applied, were vigorous enough: Of which ſort I remember I have ſeen one (and made ſome tryals with it) that yielded an income to the owner, who received money from Navigators and others for ſuffering them to touch their needles, ſwords, knives &c. at his excellent Magnet. Now, in a piece of ſteel or iron thus excited, 'tis plain, that the Magnetic operations may be regularly performed for whole years by a body, to which the form of a Loadſtone does not belong, ſince, as it had its own form before, ſo it retains the ſame ſtill, continuing as malleable, fuſible &c. as an ordinary piece of the ſame metal unexcited: ſo that, if there be introduced a fit diſpoſition into the internal parts of the metal by the action of the Loadſtone, the metal, continuing of the ſame *ſpecies* it was before, will need nothing ſave the continuance of that acquired diſpoſition to be capable of performing Magnetical Operations; and if this diſpoſition or inter-

nal conſtitution of the excited iron be deſtroyed, though the form of the metal be not at all injured, yet the former power of Attraction ſhall be aboliſhed, as appears when an excited iron is made red hot, in the fire, and ſuffered to cool again.

EXPER. II.

And here give me leave to take notice of what I have elſewhere related to another purpoſe, namely that a Loadſtone may (as I have more than once tryed) be eaſily deprived by ignition of its Power of ſenſibly attracting Martial bodies, and yet be ſcarce, if at all, viſibly changed, but continue a true Loadſtone in other capacities, which, according to the vulgar Philoſophy ought to depend upon its *Subſtantial Form*, and the Loadſtone thus ſpoiled may, notwithſtanding this Form, have its Poles altered at pleaſure like a piece

EXPER. III.

piece of Iron; as I have elſewhere particularly declared.

And I will confirm what I have been ſaying with an experiment that you do not perhaps expect; namely, that though it be generally taken for granted (without being contradicted that I know of by any man) that, in a ſound Loadſtone, that has never been injured by the fire, not only the attractive Power, but the particular Vertue that it has to point conſtantly, when left to it ſelf, with one of its determinate extreams to one determinate pole, flowes immediately from the ſubſtantial or at leaſt eſſential Form; yet this Form remaining undeſtroyed by Fire, the Poles may be changed, and that with eaſe and ſpeed. For among my notes about Magnetical Experiments, whence I borrow ſome paſſages of this paper, I find the following Account.

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EXPER. IV.

TO shew that the virtue that a Loadstone hath by this determinate Pole or Extream to attract, for example, the South-end of a poised needle, and with the opposite extream or Pole the North-end of the same needle, I made among other tryals the following Experiment.

Taking a very small fragment of a Loadstone, I found, agreeably to my conjecture, that by applying sometimes one Pole, sometimes the other, to that pole of (a small but) a very vigorous Loadstone that was fit for my purpose, I could at pleasure, in a few minutes, change the Poles of the little fragment, as I tryed by its operations upon a needle freely poised; though by applying a fragment a pretty deal bigger, (for in it self it appeared very small,) I was not able in far more hours than I employed minutes before, to make any sensible change of the Poles.

This

This ſhort Memorial being added to the preceding part of this diſcourſe, will, I hope, ſatisfie you, that how unanimouſly ſo ever men have deduced all magnetick operations from the form of the Loadſtone; yet ſome internal change of pores or ſome other Mechanical alterations or inward diſpoſition, either of the excited Iron or of the Loadſtone it ſelf, may ſuffice to make a body capable or uncapable of exerciſing ſome determinate magnetical operations; which may invite you to caſt a more unprejudiced eye upon thoſe few particulars, I ſhall now ſubjoin to make it probable, that even Magnetical Qualities may be Mechanically produced or altered.

EXPER. V.

I Have often obſerved in the ſhops of Artificers, as Smiths, Turners of metals &c. that, when hardened and well tempered tools are well heated by Attrition, if whileſt

whileſt they are thus warmed you apply them to filings or chips, as they call them, or thin fragments of Steel or Iron, they will take them up, as if the inſtruments were touched with a Loadſtone; but as they will not do ſo, unleſs they be thus excited by rubbing till they be warmed, by which means a greater commotion is made in the inner parts of he Steel ſo neither would they retain ſo vigorous a Magnetiſm as to ſupport the little fragments of Steel that ſtuck to them after they were grown cold again. Which may be confirmed by what, if I much miſremember not, I ſhewed ſome Acquaintances of yours; which was, that, by barely rubbing a conveniently ſhaped piece of Steel againſt the floor till it had gained a ſufficient heat, it would whileſt it continued ſo, diſcover a manifeſt, though but faint attractive power, which vaniſhed together with the adventitious Heat.

EXPER. VI.

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EXPER. VII.

WE elsewhere observe, which perhaps you also may have done, that the Iron bars of windows, by having stood very long in an erected posture, may at length grow Magnetical, so that, if you apply the North point of a poised and excited Needle to the bottom of the Bar, it will drive it away, & attract the Southern; and if you raise the magnetick needle to the upper part of the Bar, and apply it as before, this will draw the Northern extream, which the other end of the bar expelled; probably because, as 'tis elsewhere declared, the bar is in tract of time, by the continual action of the Magnetical *effluvia* of the Tarraqueous Globe, turned into a kind of Magnet, whose lower end becomes the North-pole of it, and the other the Southern. Therefore according to the Magnetical Laws, the former must expel the Northern extream

tream of the Needle, and the later draw it.

EXPER. VIII.

I Have found indeed, and I queſtion not but other obſervers may have done ſo too, that, if a bar of Iron, that has not ſtood long in an erected poſture, be but held perpendicular, the forementioned experiment will ſucceed, (probably upon ſuch an account as that I have lately intimated:) But then this virtue, diſplayed by the extreams of the bar of Iron, will not be at all permanent, but ſo tranſient, that, if the bar be but inverted and held again upright, that end which juſt before was the uppermoſt, and drew the north-end of the needle, will now, being lowermoſt, drive it away, which, as was lately obſerved, will not happen to a bar which has been ſome years or other competent time kept in the ſame Poſition. So that, ſince

ſince length of time is requiſite to make the verticity of a bar of Iron ſo durable & conſtant, that the ſame extream will have the ſame virtues in reference to the Magnetical needle, whether you make it the upper end or the lower end of the bar, it ſeems not improbable to me, that by length of time the whole Magnetick virtue of this Iron may be increaſed, and conſequently ſome degree of attraction acquired.

And by this Conſideration I ſhall endeavour to explicate that ſtrange thing, that is reported by ſome Moderns to have happened in *Italy*, where a bar of Iron is affirmed to have been converted into a Loadſtone, whereof a piece was kept among other rarities in the curious *Aldrovandus* his *Muſæum Metallicum*. For conſidering the greatneſs of its Specific Gravity, the malleableneſs and other properties, wherein Iron differs from Loadſtone, I cannot eaſily believe, that, by ſuch a way as is mentioned, a metal ſhould be turned into

into a ſtone. And therefore, having conſulted the book it ſelf, whence this Relation was borrowed, I found the ſtory imperfectly enough delivered: The chiefeſt and cleareſt thing in it being, that at the top of the Church of *Arimini* a great iron-bar, that was placed there to ſupport a Croſs of an hundred pound weight, was at length turned into a Loadſtone. But whether the reality of this tranſmutation was examined, and how it appeared that the fragment of the Loadſtone preſented to *Aldrovandus* was taken from that bar of Iron, I am not fully ſatisfied by that Narrative. Therefore, when I remember the great reſemblance I have ſometimes ſeen in colour, beſides other manifeſt Qualities, betwixt ſome Loadſtones and ſome courſe or almoſt ruſty Iron, I am tempted to Conjecture, that thoſe that obſerved this Iron-bar when broken to have acquired a ſtrong Magnetical virtue, which they dreamed not that tract of time might com-

communicate to it, might eaſily be perſwaded, by this virtue and the reſemblance of colour, that the Iron was turned into Loadſtone: eſpecially they being prepoſſeſs'd with that *Ariſtotelian* Maxim, whence our Author would explain this ſtrange *Phænomenon*, that *inter Symbolum habentia facilis eſt tranſmutatio.*

But, leaving this as a bare conjecture, we may take notice, that what virtue an oblong piece of Iron may need a long tract of time to acquire, by the help onely of its poſition, may be imparted to it in a very ſhort time, by the intervention of ſuch a nimble agent, as the fire. As may be often, though not always, obſerved in Tongs, and ſuch like Iron Utenſils, that, having been ignited, have been ſet to cool, leaning againſt ſome wall or other prop, that kept them in an erected poſture, which makes it probable that the great commotion of the parts, made by the vehement heat of the fire, diſpoſed

EXPER. IX.

the Iron, whilst it was yet soft, and had its pores more lax, and parts more pliable, disposed it, I say, to receive much quicker impressions from the Magnetical *effluvia* of the Earth, than it would have done, if it had still been cold.

EXPER. X. And 'tis very observable to our present purpose, what differing effects are produced by the operation of the fire, upon two Magnetick bodies according to their respective constitutions. For, by keeping a Loadstone red-hot, though you cool it afterwards in a perpendicular posture, you may deprive it of its former power of manifestly attracting: But a bar of Iron being ignited, and set to cool perpendicularly, does thereby acquire a manifest verticity. Of which differing events I must not now stay to inquire, whether or no the true reason be, That the peculiar Texture or internal constitution that makes a Loadstone somewhat more than an ordinary Ore of Iron, (which metal,

metal, as far as I have tried, is the usual ingredient of Loadstones) being spoiled by the violence of the fire, this rude Agent leaves it in the condition of common Iron, or perhaps of ignited Iron-ore: whereas the fire does soften the Iron it self (which is a metal not an Ore) agitating its parts, and making them the more flexible, and by relaxing its pores, disposes it to be easily and plentifully pervaded by the Magnetical steams of the Earth, from which it may not improbably be thought to receive the verticity it acquires; and this the rather, because, as I have often tryed, and elsewhere mentioned, if an oblong Loadstone, once spoil'd by the fire, be thorowly ignited and cooled either perpendicularly, or lying horizontally North and South, it will, as well as a piece of Iron handled after the same manner, be made to acquire new poles, or change the old ones, as the skilful experimenter pleases.

EXPER. XI.

But whatever be the true cauſe of the diſparity of the fires operation upon a ſound Loadſtone and a bar of Iron, the effect ſeems to ſtrengthen our conjecture, That Magnetical operations may much depend upon Mechanical Principles. And I hope you will find further probability added to it, by ſome Phænomena recited in another paper, to which I once committed ſome promiſcuous Experiments and Obſervations Magnetical.

EXPER. XII.

IF I may be allowed to borrow an Experiment from a little Tract * that yet lyes by me, and has been ſeen but by two or three friends, it may be added to the inſtances already given about the production of Magnetiſm. For in that Experiment I have ſhewn, how having brought a good piece of a certain kind of Engliſh *Oker*, which yet perhaps was no fitter

* *Relating to the Magnetiſm of the Earth.*

fitter than other, to a convenient shape, though, till it was altered by the fire, it discovered no Magnetical Quality; yet after it had been kept red-hot in the fire and was suffered to cool in a convenient posture, it was enabled to exercise Magnetical operations upon a pois'd Needle.

EXPER. XIII.

As for the Abolition of the Magnetical vertue in a body endow'd with it, it may be made without destroying the Substantial or the Essential Form of the body, and without sensibly adding, diminishing, or altering any thing in reference to the Salt, Sulphur and Mercury, which Chymists presume Iron and Steel, as well as other mixt bodies, to be composed of. For it has been sometimes observed, that the bare continuance of a Loadstone it self in a contrary position to that, which, when freely placed, it seems to effect, has either corrupted or sensibly lessened the vertue of it. What I formerly observed to this purpose, I elsewhere relate, and since that having a Loadstone, whose vigor was look'd upon by skilful persons as very extraordinary, and which, whilst it was in an Artificers hand, was therefore held at a high rate, I was careful, being by

by ſome occaſions call'd out of *London*, to lock it up with ſome other rarities, in a Cabinet, whereof I took the key along with me, and ſtill kept it in my own Pocket. But my ſtay abroad proving much longer than I expected, when, being returned to *London*, I had occaſion to make uſe of this Loadſtone for an Experiment, I found it indeed where I left it, but ſo exceedingly decayed, as to its attractive power, which I had formerly examin'd by weight, by having lain almoſt a year in an inconvenient poſture, that if it had not been for the circumſtances newly related, I ſhould have concluded that ſome body had purpoſely got it out in my abſence, and ſpoiled it by help of the fire, the vertue being ſo much impaired, that I cared little to employ it any more about conſiderable Experiments.

EXPER. XIV. And this corruption of the Magnetical vertue, which may in tract of time be made in a Loadſtone it ſelf, may in a trice be made by the help of that Stone in an excited Needle. For 'tis obſerv'd by Magnetical Writers, and my own Trials purpoſely made have aſſured me of it, that a well pois'd Needle, being by the touch of a good Loadſtone, excited and brought to turn one of its ends to the North and the other

other to the South, it may by a contrary touch of the same Loadstone be deprived of the faculty it had of directing its determinate extreams to determinate Poles. Nay, by another touch (or the same, and even without immediate Contact, if the Magnet be vigorous enough) the Needle may presently have its direction so changed, that the end, which formerly pointed to the North pole, shall now regard the South, and the other end shall instead of the Southern, respect the Northen pole.

EXPER. XV.

AND to make it the more probable, that the change of the Magnetism communicated to Iron may be produc'd at least in good part by Mechanical operations, procuring some change of texture in the Iron; I shall subjoyn a notable Experiment of the ingenious Doctor *Power*, which when I heard of, I tryed as well as I could; and though, perhaps for want of convenience, I could not make it fully answer what it promised, yet the success of the trial was considerable enough to make it pertinent in this place, and to induce me to think, it might yet better succeed with him, whose Experiment, as far as it concerns my present purpose, imports, that if

if a Puncheon, as Smiths call it, or a Rod of Iron, be, by being ignited and suffered to cool North and South, and hammered at the ends, very manifestly endow'd with Magnetical vertue, this vertue will in a trice be destroyed, by two or three smart blows of a strong hammer upon the middle of the oblong piece of Iron.

But *Magnetism* is so fertile a Subject, that if I had now the leisure and convenience to range among Magnetical Writers, I should scarce doubt of finding, among their many Experiments and Observations, divers that might be added to those above delivered, as being easily applicable to my present Argument. And I hope you will find farther probability added to what has been said, to shew, *that Magnetical operations may much depend upon Mechanical Principles*, by some *Phænomena* recited in another Paper, to which I once committed some promiscuous Experiments and Observations Magnetical.

FINIS.